

Article Index

- Copper, Nickel, and Cobalt Trace Metal Species in Plankton, Sediment, and Manganese Nodules from the Equatorial North Pacific, 171
- Deep Ocean Mining Research Requirements for the 1980's—An Overview, 311
- Equipment for Offshore Mining, 213
- Long Pipe Strings for Deep Ocean Mining, Flow Induced Excitation of, 347
- Extraction Behavior of Metal Elements from Deep-Sea Manganese Nodules in Reducing Media, 155
- Manganese Nodule Deposits in the Northeast Equatorial Pacific, Distribution Patterns of, 1
- Manganese Nodule Extractive Metallurgy Review 1973–1978, 191
- Manganese Nodule Resources in the Indian Ocean, 257
- Nodule Abundance Estimates from Sea Floor Photographs, Some Problems in Making, 293
- Offshore Ilmenite Placers of Ratnagiri, Konkan Coast, Maharashtra, India, 91
- Physico-Chemical Characteristics of Deep-Sea Manganese Nodules, The Effect of Temperature on the, 131
- Present and Future Geotechnical Research Needs in Marine Mining, 315
- Reconnaissance Survey of Manganese Nodules from the Northern Sector of the Peru Basin, 385
- Recovery of Metals from Ocean Nodules, Comparative Economics of, 119
- Sediment Dispersal Patterns in Mineralized Nearshore Environments, Quantitative Geochemical Models of, 231
- Ship Maneuvering and Dynamics, 339
- System Design Considerations in Deep Ocean Mining Lift Systems, 357
- TAG Hydrothermal Field, Metal Enrichments in Sediments from the, 79
- Tin Off the North Coast of Cornwall and Offshore Testing of Beneficiation Equipment, 45
- Tin Placers in St. Ives Bay, Cornwall, Geochemical Exploration for, 59
- Underwater Mining Institute—A Decade of Partnership, News Note: The, 251
- University-Industry Partnership in Maine Resource Development, What is an Appropriate, 303
- Book Reviews, 151



Author Index

- Abramson, H. N., 347
Agarwal, J. C., 119
Almeida, F., 91
Andrews, James E., 1, 171
Atkinson, Keith, 45
Beecher, N., 119
Boylan, D. B., 171
Burns, Jerome B., 357
Chaney, Ronald C., 315
Cronan, D. S., 79
Davies, D. S., 119
Donkers, Jack M., 213
Eda, Haruzo, 339
Felix, David, 293
Flipse, J. R., 311
Frazer, J. Z., 257
Friedrich, Gunther H. W., 1, 385
Fuerstenau, D. W., 131, 155
Glasby, G. P., 385
Grote, Philip B., 357
Han, K. N., 131, 155
Hedden, Gregory D., 251
Hoover, M. P., 131
Hubred, G. L., 131, 191
Kakaria, V. K., 119
Kunzendorf, H., 385
Lewis, E. V., 339
Moslen, J. H., 119
Müller, D., 385
Osborne, Dave G., 45
Ostenso, Ned A., 303
Owen, Robert M., 231
Rajamanickam, G. V., 91
Richards, Adrian F., 315
Richter, H., 385
Rogers, A. C., 347
Rona, P. A., 79
Rutgers, S., 171
Schmitz-Wiechoeski, A., 385
Shearme, S., 79
Siddiquie, H. N., 91
Thijssen, T., 385
Wilson, L. L., 257
Yim, W. W.-S., 59
Zeitlin, H., 171



Marine Mining

EDITOR

J. Robert Moore
Director, Marine Science Institute
University of Texas
P.O. Box 7999, University Station
Austin, TX 78712

EDITORIAL BOARD

D. S. Cronan
Imperial College of Science
and Technology
Royal School of Mines
London, ENGLAND

Michael J. Cruickshank
U.S. Geological Survey
Reston, Virginia

K. Gosta Eriksson
Chalmers University
of Technology
and University of Goteborg
Goteborg, SWEDEN

John E. Flipse
Ocean Engineering Program
Texas A & M University
College Station, Texas

Douglass W. Fuerstenau
Department of Materials
Science and Engineering
University of California
Berkeley, California

Geoffrey Glasby
New Zealand

Oceanographic Institute
Wellington North, NEW ZEALAND

Robert W. E. Jansen
Royal Bos Kalis Westminster Group
Papendrecht, HOLLAND

Hugh Jones
Bureau of Mineral Resources
Canberra, AUSTRALIA

Raymond Kaufman
DeepSea Ventures, Inc.
Gloucester Point, Virginia

Harry van den Kroonenberg
Twente University of Technology
Department of
Mechanical Engineering
Enschede, HOLLAND

John Noakes
University of Georgia
Center for Applied Isotopes Research
Athens, Georgia

Klaus Ritter
University of Stuttgart
Stuttgart, WEST GERMANY

Andre Rossfelder
Geomarex Corporation
La Jolla, California

Georges Scolari
Bu. de Recherches Geologiques
et Minieres
Orleans, FRANCE

E. S. W. Simpson
Department of Oceanography
University of Capetown
Rodenbosch, SOUTH AFRICA

Peter Smith
Marine Science Institute
University of Texas
Austin, Texas

D. T. Thompson
Gulf Research and Development Co.
Pittsburgh, Pennsylvania

Lorne Wrigglesworth
Falconbridge Nickel Mines, Ltd.
Toronto, Ont., CANADA

MARINE MINING

Volume 2

*The Journal of
Sea-Floor Minerals—
Exploration, Assessment,
Extraction and
Ore Processing*

J. Robert Moore
EDITOR



Crane, Russak & Company, Inc.
NEW YORK

The appearance of the code at the bottom of the first page of each article in this Journal indicates the copyright owner's consent that a single copy of the article may be made for personal use. This consent is given on the condition that for multiple copies the copier pay a fee of \$2.00 per copy through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, MA 01970. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale.

Marine Mining

ISSN: 0149-0397

Published by Crane, Russak & Company, Inc.
3 East 44th Street, New York, New York, 10017

Volume 2, 1979-1981 (4 issues)

Subscription price for Volume 2: \$48.00 plus postage and handling.
Single copy price: \$13.00 plus postage and handling.

Personal subscriptions, payable by personal check and mailed to home address, are available at a reduced price.

Write to the Journals manager for information.

Copyright © 1981 Crane, Russak & Company, Inc.

No part of this publication may be stored in an electronic retrieval system or transmitted electronically without the prior written permission of the publisher.

Subscription orders and notification about change of address should be sent to the office of the publisher.

Claims for missing issues are honored only within five months of publication date.

A microform edition of this journal is available to all subscribers from University Microfilms International, Ann Arbor, Michigan 48106

In Japan, Crane Russak Journals are distributed exclusively by Kinokuniya, Tokyo.

Abstracted and/or indexed in
Applied Mechanics Review
Chemical Abstracts Service
Current Contents/Engineering, Technology and Applied Sciences
Current Contents/Physical & Chemical Sciences
Engineering Index
Environmental Abstracts
Geo Abstracts
IMM Abstracts
Institute for Scientific Information (USSR)
Petroleum Abstracts
Science Citation Index
Technology & Applied Sciences

Printed in the United States of America

Contents

Editorial	vii
Distribution Patterns of Manganese Nodule Deposits in the Northeast Equatorial Pacific James E. Andrews and Gunther H. W. Friedrich	1
Tin off the North Coast of Cornwall and Offshore Testing of Beneficiation Equipment Dave G. Osborne and Keith Atkinson	45
Geochemical Exploration for Tin Placers in St. Ives Bay, Cornwall W. W.-S. Yim	59
Metal Enrichments in Sediments from the TAG Hydrothermal Field D. S. Cronan, P. A. Rona, and S. Shearme	79
Offshore Ilmenite Placers of Ratnagiri, Konkan Coast, Maharashtra, India H. N. Siddiquie, G. V. Rajamanickam, and F. Almeida	91
Comparative Economics of Recovery of Metals from Ocean Nodules Dr. J. C. Agarwal, Dr. N. Beecher, D. S. Davies, Dr. G. L. Hubred, V. K. Kakaria, and Dr. J. H. Moslen	119
The Effect of Temperature on the Physico-Chemical Characteristics of Deep-Sea Manganese Nodules K. N. Han, M. P. Hoover, and D. W. Fuerstenau	131
Book Reviews	151

Extraction Behavior of Metal Elements from Deep-Sea Manganese Nodules in Reducing Media	155
K. N. Han and D. W. Fuerstenau	
A Comparative Study of Copper, Nickel, and Cobalt Trace Metal Species in Plankton, Sediment, and Manganese Nodules from the Equatorial North Pacific	171
D. B. Boylan, S. Rutgers, H. Zeitlin and J. E. Andrews	
Manganese Nodule Extractive Metallurgy Review 1973-1978	191
Gale L. Hubred	
Equipment for Offshore Mining	213
Jack M. Donkers	
Quantitative Geochemical Models of Sediment Dispersal Patterns in Mineralized Nearshore Environments	231
Robert M. Owen	
News Note: The Underwater Mining Institute—A Decade of Partnership	251
Gregory D. Hedden	
Manganese Nodule Resources in the Indian Ocean	257
J. Z. Frazer and L. L. Wilson	
Some Problems in Making Nodule Abundance Estimates from Sea Floor Photographs	293
David Felix	
What is an Appropriate University-Industry Partnership in Marine Resource Development?	303
Ned A. Ostenso	
Deep Ocean Mining Research Requirements for the 1980's: An Overview	311
John E. Flipse	

Present and Future Geotechnical Research Needs in Deep Ocean Mining	315
Adrian F. Richards and Ronald C. Chaney	
Ship Maneuvering and Dynamics	339
Haruzo Eda and E. V. Lewis	
Flow-Induced Excitation of Long Pipe Strings for Deep Ocean Mining Applications	347
A. C. Rogers and H. N. Abramson	
System Design Considerations in Deep Ocean Mining Lift Systems	357
Philip B. Grote and Jerome Q. Burns	
Reconnaissance Survey of Manganese Nodules from the Northern Sector of the Peru Basin	385
T. Thijssen, G. P. Glasby, A. Schmitz-Wiechowski, G. Friedrich, H. Kunzendorf, D. Müller and H. Richter	



